



PLASTIC
MOULD STEEL

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BÖHLER M340
ISOPLAST®

EXACTLY TO YOUR LIKING

An increase in productivity in high-tech mould-making can only be achieved by using mould steels with materials properties trimmed specifically towards the intended use.

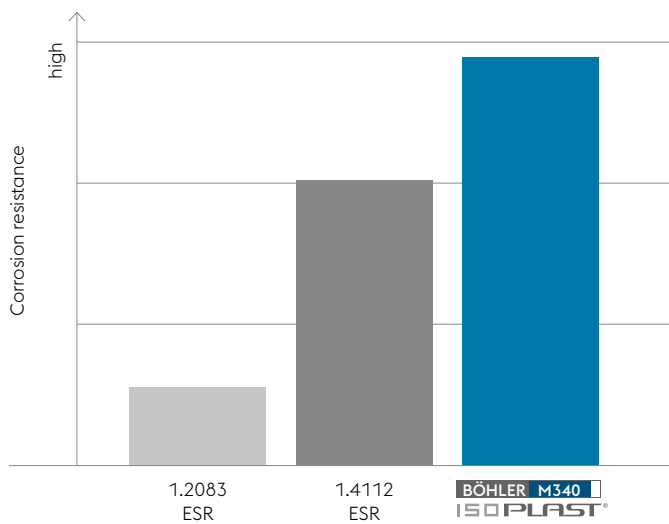
The following properties are decisive: **Wear resistance, corrosion resistance, toughness, etchability and polishability.** An optimum combination of properties appropriate to the intended use is made possible by specifically tailoring the heat treatment.

BÖHLER M340 ISOPLAST PROVIDES YOU WITH THESE ADVANTAGES.



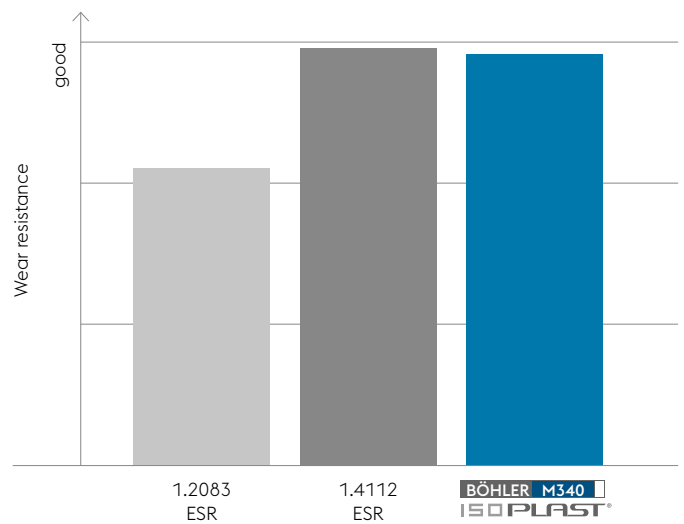


Corrosion resistance



Heat treatment with low tempering temperature

Wear resistance



Heat treatment with high tempering temperature

Chemical composition (average %)

C	Si	Mn	Cr	Mo	V	+N
0.54	0.45	0.40	17.30	1.10	0.10	

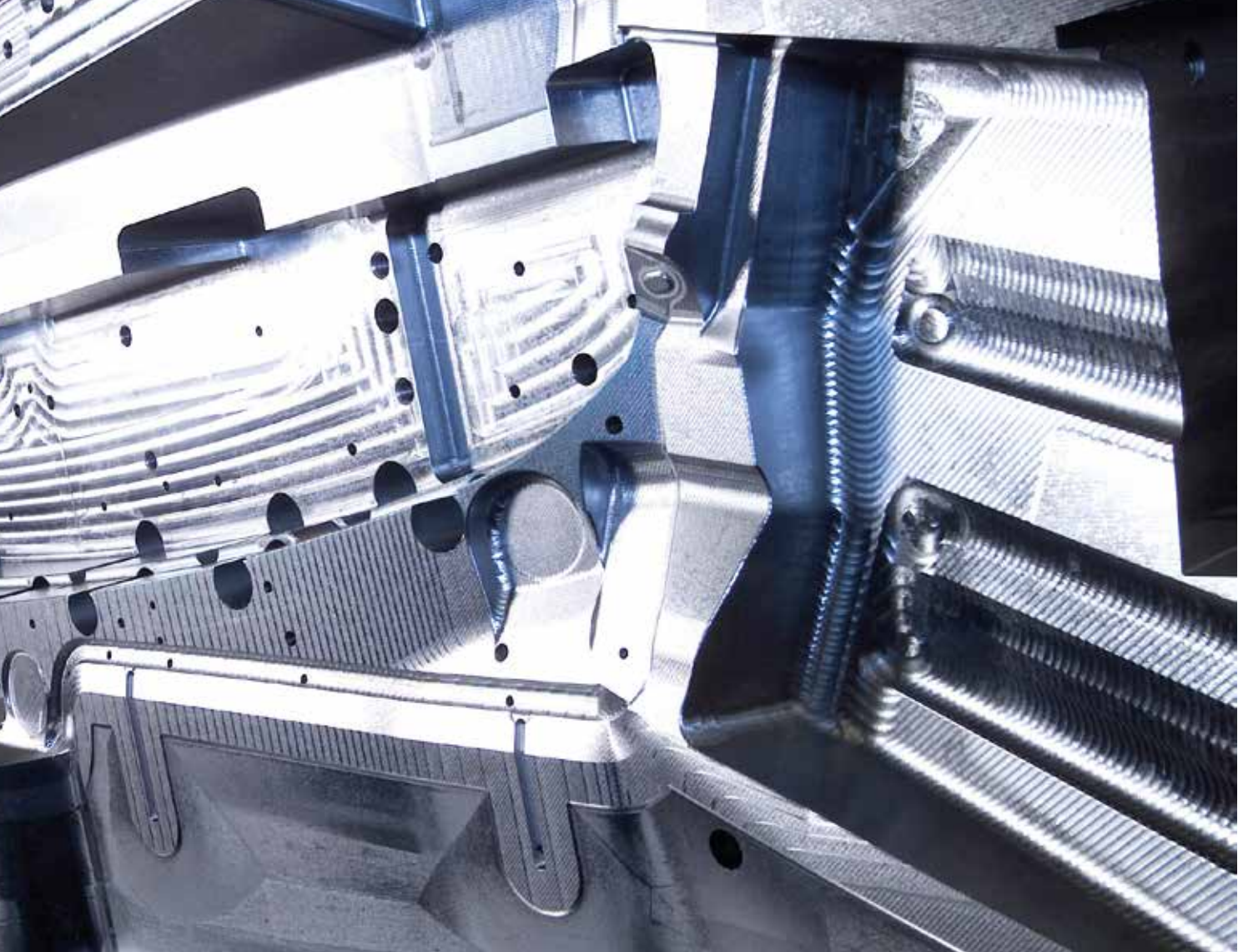
Source: Materials Center Leoben Forschung GmbH, ÖGI

A STEEL FOR EXTREMELY HIGH REQUIREMENTS

BÖHLER M340 ISOPLAST is a high performance plastic mould steel with:

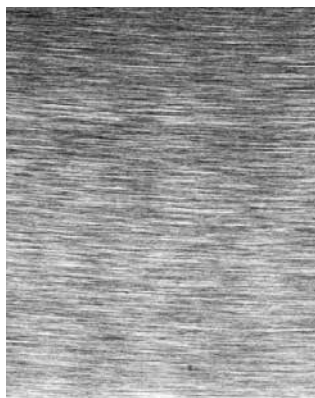
- » Excellent corrosion resistance properties
- » Suitable for heat treatment in vacuum furnaces
- » Fine carbide structure
- » Good dimensional stability with appropriate heat treatment
- » Excellent high wear resistance / edge-holdingability
- » Good machinability
- » Good polishability



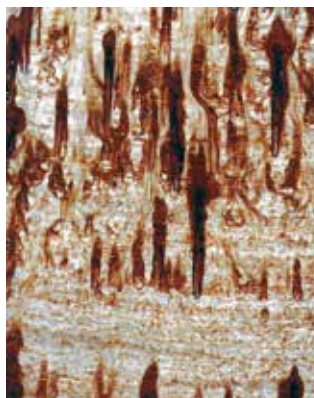


CORROSION RESISTANCE

Comparison BÖHLER M340 ISOPLAST with WNr. 1.2083 – ESR, at low tempering temperature (salt spray test acc. DIN 50021)



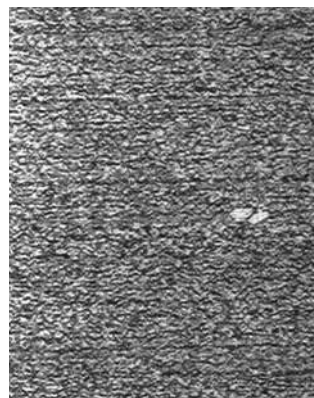
BÖHLER M340 ISOPLAST



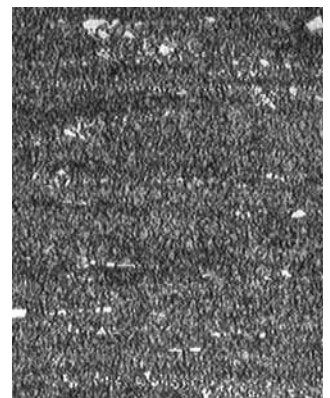
WNr. 1.2083 – ESR

MICROSTRUCTURE

Comparison BÖHLER M340 ISOPLAST with WNr. 1.4112 – ESR. The fine, homogeneous microstructure results in good machinability and properties in service.



BÖHLER M340 ISOPLAST



WNr. 1.4112 – ESR



UNIVERSAL & TOP PERFORMING

Advantages which highlight the cost saving potential of
BÖHLER M340 ISOPLAST:

Well balanced material properties for an efficient tool manufacturing process:

- » Good machinability
- » Consistently high quality
- » Good polishability
- » Dimensional stability
- » Technical assistance and advice in tool manufacture and use

The usage of BÖHLER M340 ISOPLAST demonstrates its steadiness in several requirements:

- » Highest precision parts
- » Processability of plastics containing abrasive and corrosive fillers
- » Elevated processing temperatures
- » Higher machine economy
- » Longer service life of wear parts
- » Higher overall quality



NUMBERS, FACTS AND DATA

Physical properties

Modulus of elasticity at	20 °C	219 x 10 ³ N/mm ²
Modulus of elasticity at	68 °F	31.8 x 10 ³ KSI
Density at	20 °C	7.70 kg/dm ³
Density at	68 °C	0.278 lbs/in ³
Specific heat capacity at	20 °C	460 J/(kg.K)
Specific heat capacity at	68 °C	0.110 Btu/lb°F
Thermal conductivity at	20 °C	18.2 W/(m.K)
Thermal conductivity at	68 °C	10.52 Btu/ft h°F
Magnetic properties magnetic		

Thermal expansion between 20 °C (68 °F) and ... °C (°F)

100 °C	200 °C	300 °C	400 °C	500 °C	
10.88	10.78	11.21	11.61	11.90	10 ⁻⁶ m/(m.K)
210 °F	390 °F	570 °F	750 °F	930 °F	
6.04	5.99	6.23	6.45	6.61	10 ⁻⁶ in/in°F

Modulus of elasticity

20 °C	100 °C	200 °C	300 °C	400 °C	500 °C	
219	215	209	201	193	183	10 ³ KSI
68 °F	210 °F	390 °F	570 °F	750 °F	930 °F	
31.8	31.2	30.3	29.1	28.0	26.5	10 ³ KSI

HEAT TREATMENT

Annealing

- » 800 to 850 °C (1470 – 1560 °F) / Cooling in furnace
- » Hardness after annealing: max. 260 HB.

Stress relieving

- » approx. 650 °C (1200 °F)
- » After temperature equalization, soak for 1 to 2 hours in neutral atmosphere. Slow cooling in furnace.

Hardening

- » 980 to 1000 °C (1800 – 1830 °F) / Oil
- » Holding time after temperature equalization: 15 to 30 minutes

Tempering

- » Tempering should immediately follow hardening.
- » It is recommended to temper at least twice.
- » Time in furnace: 1 hour for each 20 mm (0.79 inch) of workpiece thickness but at least 2 hours.

Structure as annealed

Ferrite + carbide

Structure as hardened

Martensite + carbide

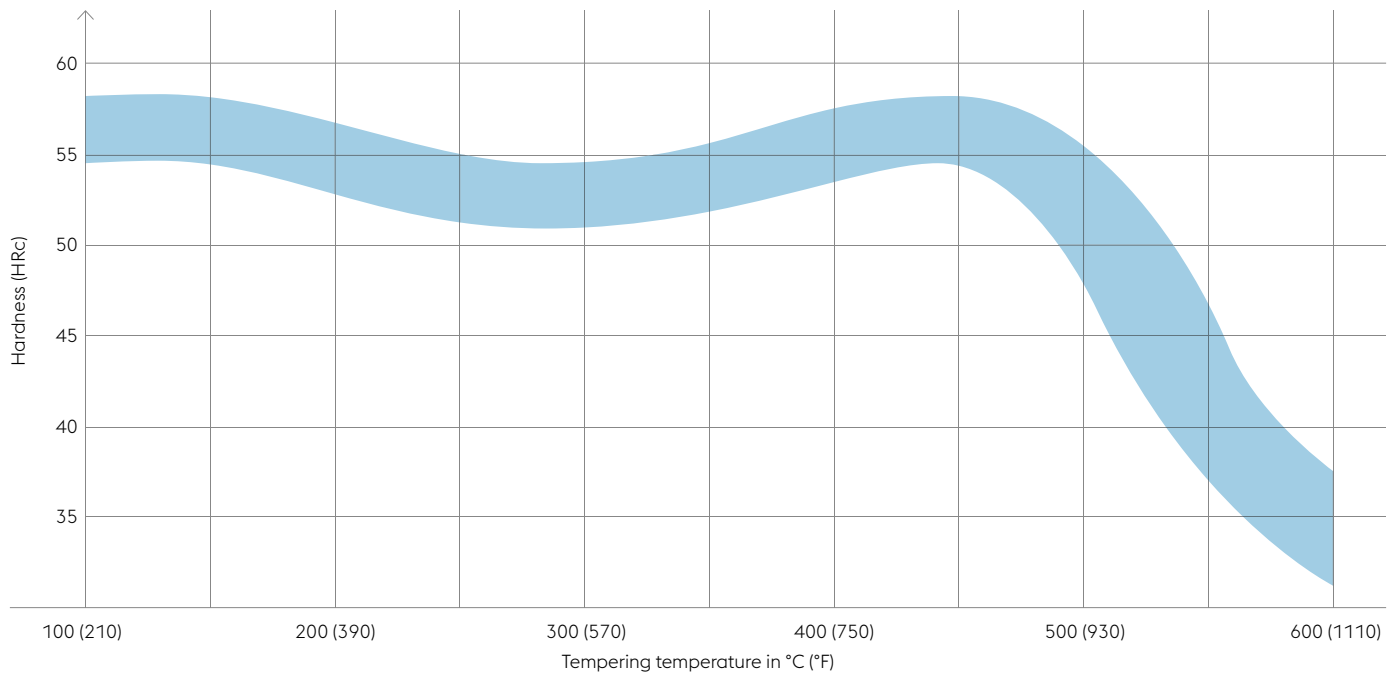
Repair welding

There is a general tendency for tool steels to develop cracks after welding. If welding cannot be avoided, the instructions of the appropriate welding electrode manufacturer should be sought and followed or check in the BÖHLER welding leaflet.





Tempering chart

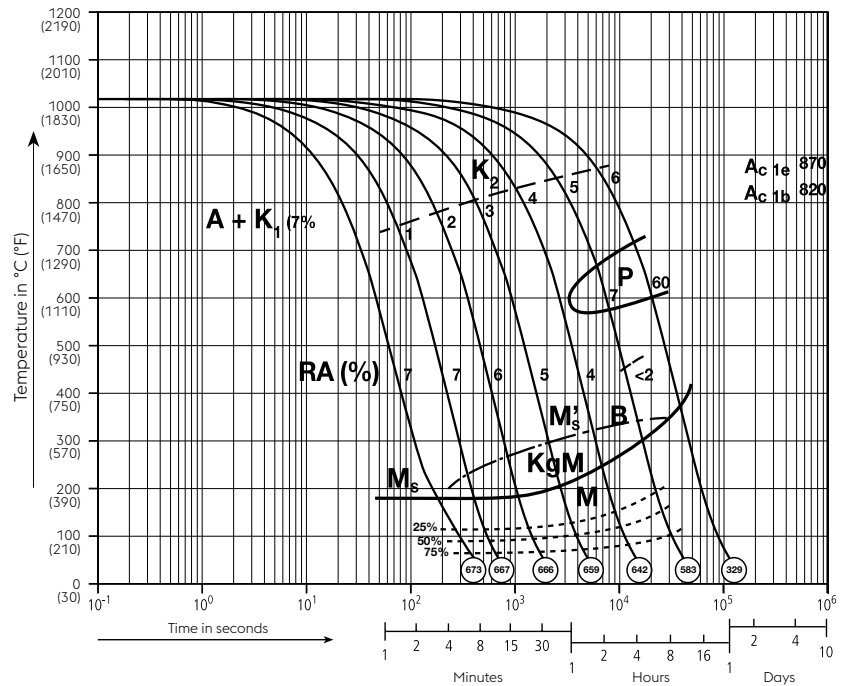




Continuous cooling CCT curves

Austenitizing temperature: 1000 °C (1830 °F)
 Holding time: 30 minutes

7...60 Phase percentages in %
 0.4...180 Cooling parameter, i.e. duration of cooling from 800 - 500 °C (1470 - 930 °F) in $s \times 10^{-2}$

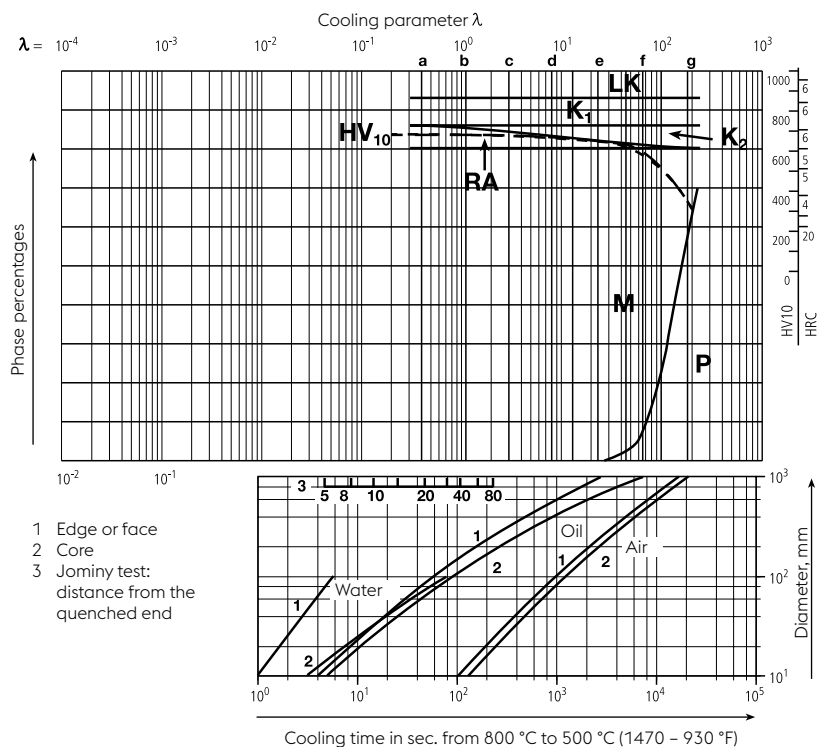




TOP PERFORMANCE THANKS TO PROPER TREATMENT

Quantitative phase diagram

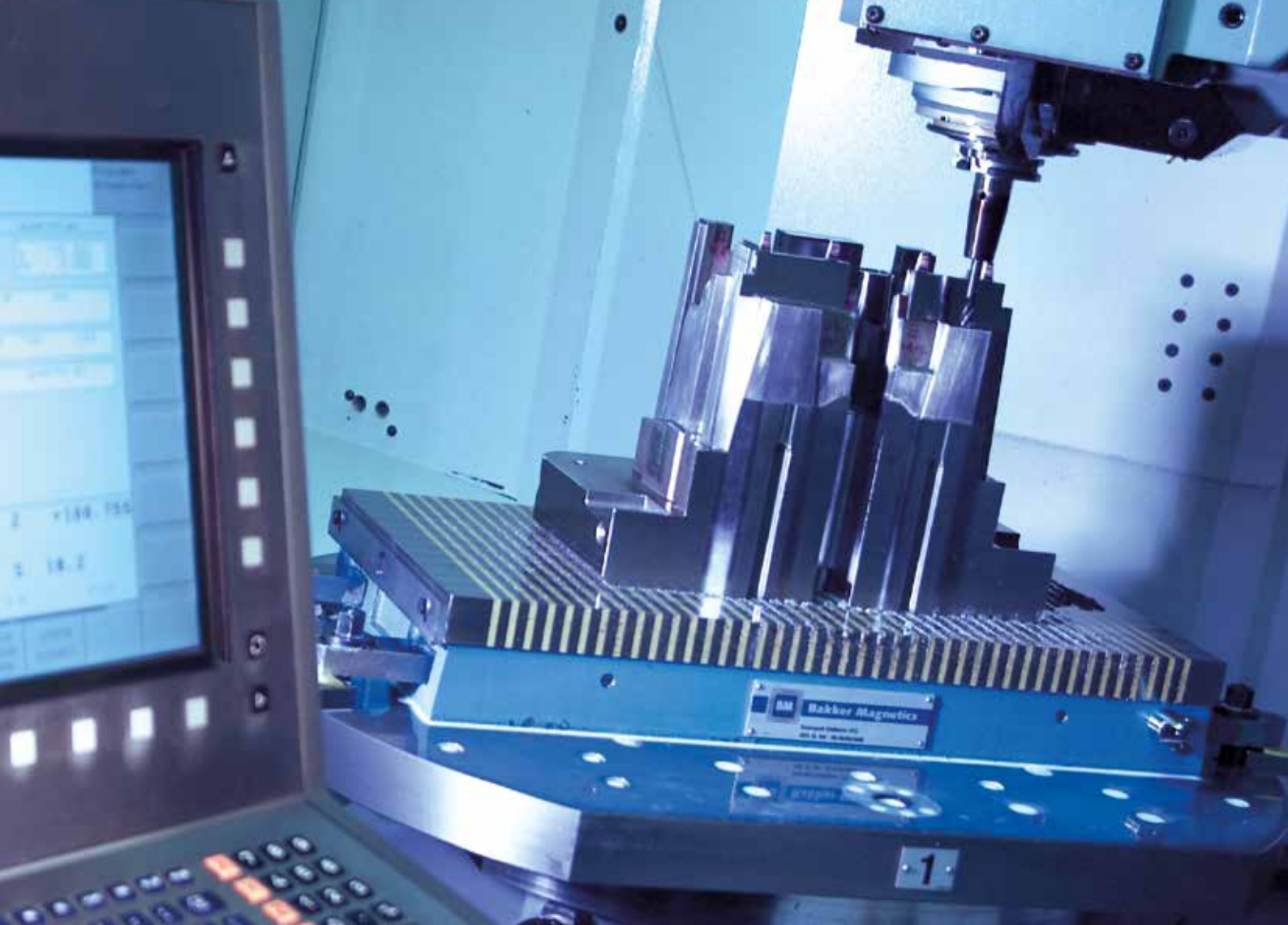
- K1 Carbides which are not dissolved during austenitization (7%)
- K2 Start of carbide precipitation during quenching from austenitizing temperature
- Ms-Ms' Range of grain boundary martensite
- LK Ledeburitic carbides
- RA Retained austenite
- A Austenite
- M Martensite
- P Perlite
- B Bainite



MACHINING GUIDELINES

Turning with sintered carbide

Depth of cut mm	0.5 - 1 (.02 - .04)	1 - 4 (.04 - .16)	4 - 8 (.16 - .31)
Feed mm/rev.	0.1 - 0.2 (.004 - .008)	0.2 - 0.4 (.008 - .016)	0.3 - 0.6 (.012 - .024)
BÖHLERIT grade	SB10, SB20, EB10	SB20, EB10, EB20	SB30, EB20, HB10
ISO grade	P10, P20, M10	P20, M10, M20	P30, M20, K10
Cutting speed v_c (m/min) (f.p.m)			
Indexable inserts Tool life: 15 min.	260 - 200 (850 - 655)	200 - 150 (655 - 490)	150 - 110 (490 - 360)
Brazed tools Tool life: 30 min.	210 - 170 (690 - 560)	170 - 130 (560 - 425)	140 - 90 (460 - 295)
Coated indexable inserts			
BÖHLERIT LC 225 C	up to 260 (850)	up to 220 (720)	up to 150 (490)
BÖHLERIT LC 235 C	up to 230 (755)	up to 180 (590)	up to 130 (425)
Tool angels for brazed tools			
Rake angle	12° - 15°	12° - 15°	12° - 15°
Clearance angle	6° - 8°	6° - 8°	6° - 8°
Inclination angle	0°	0°	-4°



Milling with inserted tooth cutter

Feed mm/tooth	up to 0.2 (.008)	0.2 - 0.3 (.008 - .012)
Cutting speed v_c (m/min) (f.p.m)		
BÖHLERIT LW 225	220 - 200 (720 - 655)	140 - 60 (460 - 195)
BÖHLERIT SB40 / ISO P40	100 - 60 (330 - 195)	70 - 40 (230 - 130)
BÖHLERIT LC 444 W	140 - 110 (460 - 360)	-

Drilling with sintered carbide

Drill diameter mm	3 - 8 (.12 - .31)	8 - 20 (.31 - .80)	20 - 40 (.80 - 1.6)
Feed mm/rev.	0.02 - 0.05 (.001 - .002)	0.05 - 0.12 (.002 - .005)	0.12 - 0.18 (.005 - .007)
BÖHLERIT/ISO grade	HB10/K10		
Cutting speed v_c (m/min) (f.p.m)			
	50 - 35 (165 - 115)	50 - 35 (165 - 115)	50 - 35 (165 - 115)
Point angle	115° - 120°	115° - 120°	115° - 120°
Clearance angle	5°	5°	5°

Condition is soft annealed, guidelines



OUR INNOVATION GROWS WITH YOUR DEMANDS

Providing you with our advice and service has long been one of our strengths, acting as the cornerstone for our corporate philosophy. The requirements are continuously being accommodated to fit the market and customers' needs.

Investments made on site in our markets in new heat treatment facilities, from saws for customized cutting to five-line machining centers, provide our customers with the advantages that enable them to considerably expand their flexibility and competitiveness.





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ONE STEP AHEAD.